

U.S. Serial No.: 10/517,906  
Applicant: Andrew Miller CAMERON, et al.  
Office Action Mailing Date: September 5, 2008  
Response to Office Action Submitted: November 5, 2008

Docket No. M02B129

### REMARKS

United States Serial No. 10/517,906 entered the U.S. National Phase on December 10, 2004, and received a 371 date of November 7, 2005. The application is subject to an objection to claims 11-13 and a final rejection of claims 1-21. In view of the amendments and arguments set forth herein, Applicants respectfully request reconsideration of the application and that a formal Notice of Allowance be issued with respect to claims 1-21.

#### Claim Amendments

Claim 10 has been amended to correct a typographical error.

Claim 1 has been amended to clarify the presently claimed subject matter. Support for these amendments can be found at page 4, line 14, and page 6, lines 29-31 of the present specification.

#### Claim Objections

Claims 11-13 have been objected to because the word oxidizing is spelled as "oxidising" at various locations within the claims. Applicants respectfully submit that "oxidising" is merely an alternate spelling of the word oxidizing. 35 U.S.C. § 361(c) states that "International applications filed in the Patent and Trademark Office shall be in the English language." Applicant respectfully submits that the word "oxidising" is the British spelling of the word, and the word is therefore in the English language. It is noted that the priority application is a British Specification, and the present application is a national phase filing of a PCT international application filed in the EPO. Applicant respectfully requests that the requirement for correction be withdrawn.

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### 35 U.S.C. § 112

Claim 10 has been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because it is allegedly unclear as to which dimension of the mean particle is 1 mm or less. Claim 10 has been amended to correct a typographical error which omitted the word "size"; this is correctly shown in the Specification at page 5, lines 21-22. Accordingly, applicants respectfully request withdrawal of the rejection of claim 10.

### 35 U.S.C. § 103

Claims 1-6 and 9-14 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over EP 1 092 785 to Mahoney, et al. ("Mahoney"), in view of US 5,366,537 to Schlichting ("Schlichting"), and further in view of US 4,425,223 to Curr, et al. Applicants respectfully note that US 4,425,223 is incorrectly identified as Curr, and further that US 4,425,223 to Miller (as the document is listed on the Notice of References Cited) is not pertinent to the subject matter of the present application. In the interest of accurate and efficient prosecution, Applicants respectfully submit that the intended citation appears to be U.S. Patent No. 4,426,223 to Curr ("Curr"), and assume that all of the arguments related to Curr within the Office Action refer to US 4,426,223, not US 4,425,223 to Miller.

Mahoney discloses a powder injection system which is designed to more efficiently deliver powder to the liquid into which the injection is being made. The injection system is comprised of separate gas and powder streams, which preferably remain distinct from the point of injection to impact upon the liquid surface. Paragraph [0021]. The gas and powder streams are enveloped by a flame shroud. The velocity of the gas stream is between 1,000 and 8,000 feet per second (fps), while the gaseous fuel stream, which ignites after exiting the injector to form the flame shroud, travels "at a velocity which is preferably less than the velocity of the gas and generally within the range of from 100 to 1,000 fps." Paragraphs [0016] and [0018]. The

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flame shroud acts to protect the gas stream from decreases in velocity and stability of the stream.  
Paragraph [0020].

Schlichting discloses a process for combusting carbonaceous material and oxygen in a smelting and/or refining operation, and an apparatus for delivering the carbonaceous material and oxygen to the furnace. The carbonaceous material and oxygen are introduced from above the furnace, and a stream of inert gas is interposed between the oxygen and carbonaceous material streams in order to prevent commingling and combustion prior to deposit in the furnace (Col. 2, lns. 10-20). The carbonaceous material is preferably delivered in a stream at a speed of between about Mach 0.75 and about Mach 2, surrounded by the inert gas stream at a speed of about Mach 0.5 to Mach 1.5, further surrounded by the oxygen stream at a speed of about Mach 0.75 to Mach 2 (Col. 3, lns. 14-19). The purpose of the process and apparatus of Schlichting is to increase the heat of combustion in the furnace in order to increase the speed of the reactions occurring within the furnace (Abstract).

It is alleged by the Office that Curr, in disclosing a process for the refining of ferrochromium, teaches injecting metals such as ferrochrome and chromite fines with a size of less than 2 mm into molten ferrochromium metal. Applicants respectfully submit that the Office has mischaracterized Curr. At column 1, lines 35-45, Curr discloses a process in which the ferrochromium metal is in the form of fines, and is preferably admixed, prior to melting, with oxide fines and any other necessary ores or fluxes. Therefore, the ferrochrome or chromium fines are not injected into molten ferrochromium; they are mixed with the ferrochromium before melting.

It is alleged by the Office that it would have been obvious to one of ordinary skill in the art to modify the process of Mahoney with the velocities and controlling thereof by Schlichting in order to minimize the migration of particles from the first stream through the second stream and into the surroundings. However, MPEP § 2143.01 states that "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention

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being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810 . . . (CCPA 1959)." MPEP at 2100-141. Since Mahoney teaches that the second stream should be traveling at a speed which is much lower than that of the first stream (100 to 1,000 fps versus 1,000 to 8,000 fps), changing the speeds of Mahoney to those of Schlichting would change the principle of operation of Mahoney, and Mahoney therefore teaches against speeds which are similar, as in Schlichting. Therefore, Applicants respectfully submit that these two references are not properly combinable.

It is further alleged by the Office that it would have been obvious to one having ordinary skill in the art to modify the combined process of Mahoney and Schlichting with the ferroalloy and particulate material of Curr in order to facilitate the refining of ferrochromium. As discussed above, Curr makes no suggestion of injecting the "fines" into a molten ferrochromium. MPEP § 2143.01 states that "[i]f proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900 . . . (Fed. Cir. 1984)." MPEP at 2100-140.

As discussed above, Mahoney and Schlichting are not combinable, but assuming, without admitting, that they are, their combination with Curr is improper because it would render the combination, or Mahoney or Schlichting individually, unsatisfactory for their intended purposes. The purpose of Mahoney is to provide a more efficient means of injecting the particulates into a liquid, shrouded by a flame jet. The purpose of Schlichting is to prevent the particulates from combining with the oxygen prior to meeting the liquid, where they are then reacted to generate heat. Combining these references with Curr would result in a complete lack of injection during reaction of any component with oxygen, therefore rendering each of the references, in turn, unsatisfactory for their intended purposes. Therefore, Applicants respectfully submit that Mahoney, Schlichting and Curr are not properly combinable in any manner.

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The present application is directed to a method of refining a ferroalloy which includes blowing molecular oxygen or a gas mixture including molecular oxygen into a melt of the ferroalloy. A metallurgically acceptable particulate material is introduced from above into the melt. The particulate material is carried into the melt in a first supersonic gas jet which travels to the melt shrouded by a second gas jet. The particulate material therefore desirably combines with the first supersonic gas jet (Abstract). The first and second jets are formed at similar velocities (preferably the second gas jet travels at a speed of 90-110% of the speed of the first gas jet) in order to confine most of the particles to the first jet without migrating to the second jet (Specification, at p. 7, lns. 13-15 and p. 12, lns. 24-26). The introduction of the particulate material into the melt has a coolant effect that helps to limit or control the temperature rise resulting from the exothermic reaction between carbon and oxygen to form carbon monoxide, which occurs due to the addition of oxygen blown in through the submerged tuyeres, and additionally from the supersonic gas jet(s) (Specification, at p. 1, lns. 14-16 and p. 4, lns. 12-29).

Mahoney teaches that it is desirable to have the second gas jet travel at a speed which is lower than that of the first jet (100 to 1,000 fps versus 1,000 to 8,000 fps, resulting in a possible 800% difference between the speeds of the two streams), and therefore teaches away from the gas jets traveling at similar speeds (i.e. within 10%).

Schlichting's process is used to increase the heat of combustion by adding combustible carbonaceous material and oxygen to the metallurgical vessel. This teaching is contrary to that of the present application, which introduces particulate material to provide a cooling effect.

As stated above, Curr discloses a process in which the ferrochromium metal is in the form of fines, and is preferably admixed, prior to melting, with oxide fines and any other necessary ores or fluxes. This teaching is contrary to that of the present application, which requires addition of the particulate material during the melt refining process.

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The combination of Mahoney, Schlichting and Curr would result in a process in which a non-combusting gas shroud travels at a speed that is simultaneously similar to the speed of the particulate and gas streams (Schlichting) and is contradictorily also a flame shroud that is much less than the speed of the particulate and gas streams (Mahoney). Further, with the addition of Curr, which teaches that the particulate material is added prior to melting, the particulate stream simultaneously exists (Mahoney and Schlichting) and doesn't exist (Curr). The particulate acts to increase the temperature of the melt in order to increase the rate of reaction occurring in the melt (Schlichting). The combination of references is therefore not physically possible, and neither this combination of references, nor any of the references individually (as discussed above), teaches or suggests the process of the present application, which requires that (1) the shroud jet travel at a speed within 10% of the speed of the particulate/gas stream, and that (2) the particulate matter be added during reaction of oxygen with carbon in the melt in order to decrease the temperature of the melt.

Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 1-6 and 9-14 over Mahoney, in view of Schlichting, and further in view of Curr, be withdrawn.

Claims 1-3, 7, 9 and 11-14 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mahoney, in view of Schlichting, and further in view of JP 08-092627 to Higuchi, et al. ("Higuchi").

It is alleged by the Office that it would have been obvious to one of ordinary skill in the art to modify the process of Mahoney with the velocities and controlling thereof by Schlichting in order to minimize the migration of particles from the first stream through the second stream and into the surroundings. As discussed above, Mahoney and Schlichting are not properly combinable, as they each teach the opposite result of velocity control.

It is further alleged by the Office that it would have been obvious to one having ordinary skill in the art to modify the combined process of Mahoney and Schlichting with the ferroalloy

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and particulate material of Higuchi in order to facilitate the refining of stainless steel. Higuchi discloses adding a chromium-oxide containing slag in powder form to stainless steel during the rough or finish carburizing stage by a blowing or injecting method, but does not disclose the specific method by which blowing or injecting occurs.

The combination of these references would therefore provide for a process in which the shroud jet travels at a speed that is simultaneously similar to (Schlichting) and much less than (Mahoney) the speed of the particulate and gas streams, in which particulate matter comprising chromium oxide containing slag is added in the second stream. This combination is physically impossible, and, as discussed above, does not teach the subject matter of the present claims.

However, as Mahoney and Schlichting are not properly combinable as discussed above, combining Higuchi does not rectify the deficiencies of Mahoney or Schlichting individually, admitted by the Office in the Final Office Action and discussed above. Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 1-3, 7, 9 and 11-14 over Mahoney, in view of Schlichting, and further in view of Higuchi, be withdrawn.

Claims 1-2, 8-9 and 11-14 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mahoney, in view of Schlichting, and further in view of JP 62-230953 to Yamamoto ("Yamamoto").

It is alleged by the Office that it would have been obvious to one of ordinary skill in the art to modify the process of Mahoney with the velocities and controlling thereof by Schlichting in order to minimize the migration of particles from the first stream through the second stream and into the surroundings. As discussed above, Mahoney and Schlichting are not properly combinable, as the combination would result in ignoring the clear directions in one or the other reference with respect to the relative velocities and combustive properties of the gas streams.

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It is further alleged by the Office that it would have been obvious to one having ordinary skill in the art to modify the combined process of Mahoney and Schlichting with the ferroalloy and particulate material of Yamamoto in order to facilitate the refining of ferromanganese. However, since Mahoney and Schlichting are not properly combinable, combining the subject matter of Yamamoto, which discloses mere "blowing", rather than injection, and which does not specify how the particulates are added, with either of Mahoney or Schlichting, does not rectify the deficiencies of Mahoney and Schlichting, as discussed above.

The combination of Mahoney, Schlichting and Yamamoto would therefore provide for a process in which the flame shroud travels at a speed that is simultaneously similar to (Schlichting) and much less than (Mahoney) the speed of the particulate and gas streams, in which the particulates are simultaneously injected into (Mahoney and Schlichting) and blown into (Yamamoto) the melt. This combination is physically impossible, and, as discussed above, does not teach the subject matter of the present claims.

Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 1-2, 8-9 and 11-14 over Mahoney, in view of Schlichting, and further in view of Yamamoto, be withdrawn.

Claims 15-18 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mahoney, in view of Schlichting, further in view of any one of Curr, Higuchi, and Yamamoto, and even further in view of US 6,558,614 to Fritz ("Fritz").

As discussed above, the combination of Mahoney and Schlichting is improper, as it would result in ignoring the clear directions in one or the other reference with respect to the relative velocities and combustive properties of the gas streams. Further, also as discussed above, the combination of Mahoney and Schlichting with any one of Curr, Higuchi, and Yamamoto is also insufficient to render the present claims obvious. The deficiencies of these references individually, admitted by the Office in the Final Office Action and as discussed above,

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or in combination (as discussed above), are not cured by merely combining Fritz's disclosure of the use of Laval nozzles in a process for melting metal in a metallurgical vessel, because Fritz does nothing to cure the inoperability of the combination of Mahoney, Schlichting, and any one of Curr, Higuchi, and Yamamoto. Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 15-18 over Mahoney, in view of Schlichting, further in view of any one of Curr, Higuchi, and Yamamoto, and even further in view of Fritz, be withdrawn.

Claims 19-21 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mahoney, in view of Schlichting, further in view of Yamamoto, and even further in view of GB 2 054 655 to Marukawa, et al. ("Marukawa").

The failure of the combination of Mahoney and Schlichting and the combination of Mahoney and Schlichting with Yamamoto to suggest the present claims are both discussed above. The deficiencies of these references individually, admitted by the Office in the Final Office Action and as discussed above, or in combination (as discussed above) are not cured by merely combining Marukawa's disclosure of a refining process of steel which teaches a refining operation wherein the powder supplied together with a top-blowing oxygen jet operates during a two to eighteen minute interval of a twenty-six minute refining operation, because Marukawa does nothing to cure the inoperability of the combination of Mahoney, Schlichting and Yamamoto, as discussed above. Applicants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 19-21 over Mahoney, in view of Schlichting, further in view of Yamamoto, and even further in view of Marukawa, be withdrawn.

#### **Double Patenting**

Claim 1 has been provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1-3, 5 and 9 of copending U.S. Serial No. 10/512,187 in view of any one of US 4,425,223 (should be 4,426,223 to Curr, as discussed above), JP 08-092627 to Higuchi, et al., and JP 62-230953 to Yamamoto.

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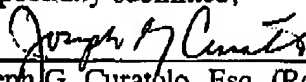
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Applicants submit herewith a completed Terminal Disclaimer to Obviate a Provisional Double Patenting Rejection Over a Pending "Reference" Application. Applicants therefore respectfully submit that the double patenting rejection is thereby rendered moot, and respectfully request withdrawal of the double patenting rejection of claim 1.

In view of the above amendments and remarks, as well as the submission of the Terminal Disclaimer, Applicants respectfully request withdrawal of the objections to claims 11-13 and the 35 U.S.C. §§ 112 and 103 rejections of claims 1-21, and request the issuance of a formal Notice of Allowance for claims 1-21.

Should the Examiner have any questions about the above remarks, the undersigned attorney would welcome a telephone call.

Respectfully submitted,

  
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